

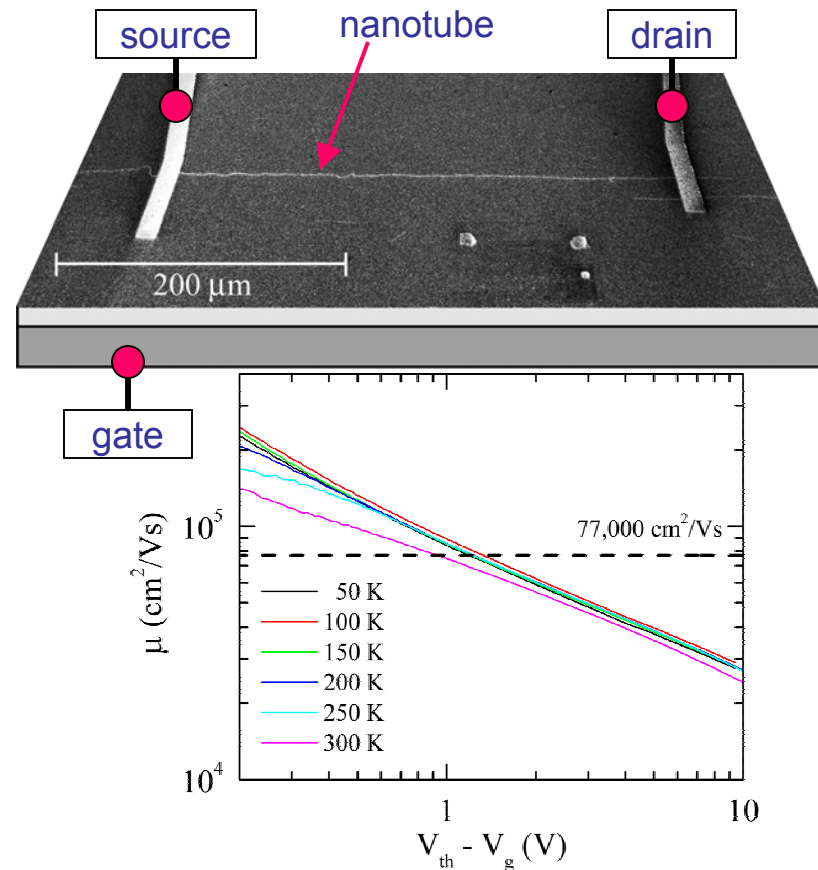
Nanotubes are Highest Mobility Semiconductors at Room Temperature

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In order to study the intrinsic conduction properties of semiconducting carbon nanotubes, NIRT researchers constructed special nanotube transistors. They used extremely long nanotubes (almost a third of a millimeter long, about 100 times longer than previous devices) with Ohmic electrical contacts in order to ensure that the nanotube resistance dominated the measured resistance.

The NIRT researchers were able to measure the intrinsic mobility in a semiconducting nanotube transistor for the first time, and found that the room-temperature mobility is higher than in any other semiconductor. Mobility is the conductance per charge, and determines how fast charges move in the semiconductor, and how sensitive it is to nearby charges or electric fields. This result shows nanotubes could be used for ultra-high-speed transistors as well as highly sensitive chemical detectors.

"Extraordinary Mobility in Semiconducting Carbon Nanotubes," T. Dürkop, S. A. Getty, Enrique Cobas, and M. S. Fuhrer, *Nano Letters ASAP* (Web Release Date: 03-Dec-2003).



Semiconducting Nanotube Mobility

Top: Long nanotube transistor. (Thin horizontal light line is nanotube). Bottom: Mobility of a 325 micron-long nanotube transistor as a function of gate voltage. The dashed line indicates the mobility in InSb, the previous room-temperature record.

Maryland NIRT Education and Outreach Activities

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Educational activities:

To date 1 undergraduate, 6 grad students, and 2 post-docs have received training an interdisciplinary nanoscience including chemistry, physics, and materials science. Undergraduates and graduate students participate in a weekly journal club, and graduate students present their ongoing research to their peers once a semester.



Graduate student (hand at upper left) works with two elementary school students in a (messy) outdoor activity involving the preparation of “silly putty” and experiments on its materials properties.



The PI (left) demonstrates conservation of angular momentum to an elementary school student at the physics department's open house.

Outreach activities:

In addition to formal academic training and research training, our NIRT graduate students are also involved in public outreach activities, which are designed to provide them with life skills in communicating the excitement of scientific research to the general public. Each student participates in 20 hours per year of activities that involve one-on-one contact with K-12 students from the local school systems. The activities are organized and coordinated by the staff of the University of Maryland NSF MRSEC, who also provide the students with training in effective outreach skills.